An Investigation Of Students' Attitude Towards Learning Mathematics In Digital And Traditional Classroom : A Study Of Secondary Students In Guwahati City

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Abstract:

The attitude of secondary students can be influenced by the teacher's attitude, personality, and teaching approach in the classroom. The success of students in mathematics is determined by their positive attitude toward the topic, the teachers' teaching approaches, and the school environment. The purpose of the study was to find out how students feel about learning mathematics in both digital and traditional classrooms. The research is based on a survey of secondary school students (9th grade) in Guwahati city from both the government and private sectors that includes students of both genders. The study included a sample of 400 students (digital classroom-186, traditional classroom-214) from both government and private institutions. A 5-point likert scale questionnaire comprising 20 items (alpha=0.799) was utilised to collect data from the respondents to investigate the attitude of students after they had been validated and their reliability verified . Means, standard deviation, t-test, and correlation were used to analyse the data. This study found that digital learning has a greater impact on students' attitudes than traditional classroom education, in case of both male and female students, government and private, SEBA and CBSE.

Keywords: Attitude, Mathematics, Secondary students, Digital and traditional classroom

INTRODUCTION

Mathematics is a branch of science that deals with numbers, computation, measurement, amount, figure, and structure. Mathematics simplifies abstract concepts and forms so that we may understand and apply them. Modern mathematics teaches students to comprehend multiple structures in arithmetic, algebra, geometry, and other subjects. In the previous two decades, mathematics has made significant development in school curricula, with new topics and concepts being added to strengthen students' fundamental knowledge. "Mathematics should be visualized as the vehicle to train a child for developing their reasoning , thinking power and creativity" according to the National Policy of Education (1986) (with modifications made in 1992). Modern mathematics has made the discipline more engaging, pleasant, systematic, current, and rational, allowing students to study mathematics more quickly and efficiently. The mathematics curriculum, according to Ngussa and Mbuti (2017)reported in Mazana,M.Y.(2019), is designed to give students with information and abilities that are necessary in today's rapidly changing technological environment.

Teaching and learning are inextricably linked in the educational system. In today's world, education may not be possible without teaching, and learning is useless without teaching.

Traditional methods such as lecturing, discussion, and inquiry are no longer sufficient to pique secondary students' interest in their subject matter. Shavinina (2001) states that "Teaching with the chalk board, textbooks, radio/television and film have been used for educational purpose over the years, none has quite impact on the educational process like computer and Internet, while television and film has impact on the audiovisual facilities of the users." He refers that technology has the power to provide users with greater interaction potential in order to help them enhance their intellectual and creative abilities. Secondary students desire to accept new learning approaches in the mathematics classroom by integrating advanced technology. The use of technology has had a significant impact on how people teach and learn. Technology has a powerful and significant impact of mathematics education. Baek , Jong and Kim(2008)pointed out that "Technology is an efficient cognitive tool and instructional media ." They also suggested, "Technology can be helpful in classroom setting by encouraging, inquiry, helping communication, constructing teaching materials and assisting students' self–expression''. Technology boosts students' enthusiasm to learn, their performance, and their degree of knowledge retention, as well as their active participation in classroom lessons. The National Council of Teachers of Mathematics (NCTM) has underlined the necessity of using technology in the mathematics classroom. They also suggests that "Technology can have a crucial role in teaching and learning mathematics; it both influences the mathematics that is taught and enhances students' learning (NCTM, 2000)(p.24)."

ABOUT ICT

Information and Communication Technology (ICT) is a subset of Information Technology (IT) that encompasses all technologies that provide telecommunications-based access to information. Through the use of electronic mass media, information technology shares and exchanges the knowledge, mental abilities, motor abilities and attitude among users. The word "communication technology" refers to the numerous types of correspondence that are available, as well as technological breakthroughs. ICT is an electronic medium for collecting, producing, storing, transmitting, organising, receiving, and delivering information with optimal precision and efficiency from one location to another. Computers, the internet, mobile phones, radio, television, video conferencing, social networking, wireless networking, software, and hardware are all included. ICT improves learning by facilitating contact and cooperation, as well as increasing student motivation. In today's global society, information and communication technology (ICT) has become a new paradigm for teaching and learning.According to Gutterman (2009), information and communication technology (ICT) can be a very effective enabler for bringing beneficial and long-term development to countries all over the world..

Importance of ICT :

Information and Communication Technology is becoming a global village as a result of technological advancements. It has lowered the time limit as well as the obstacles of communication and information distances. As a result, ICT has a significant impact on practically every aspect of society, including business, industry, science and technology, and education. ICT aids in the simpler clarification of concepts and the accurate interpretation of data. It can be used to help learners gain necessary knowledge, improve understanding, skills, attitudes, interest, and appreciation, and bring about desired behavioural changes. Knowledge and information about everything, such as people, places, ideas, concepts, and principles, cannot

be static and are always changing as a result of information and communication. The volume of information is growing due to the explosion of knowledge in various domains such as science and technology. To execute communication easily and inexpensively in less time, it requires an organised scientific technical system of information and communication technology. Students can develop themselves by using information and communication technology to get the information they need. By accumulating knowledge and information through information and communication technology, they can satisfy their inner users' desires for curiosity, inventiveness, and creativity, among other things. They can change their behaviour by learning more about this technology. Students can improve their problem-solving and decision-making abilities by fertilising their knowledge with information and knowledge from a variety of sources.

Students attitude towards mathematics :

Students' attitudes about mathematics reflect their good or negative emotional reactions to the topic in terms of how they think, feel, and perceive it (Jovanovic and King 1998). According to Neale (1969), students' attitudes are defined by a like or dislike of mathematics, as well as a disposition to engage in or avoid mathematical activities. From multidimensional point, Hart(1989) defines students' attitude as " It is some emotions that he/she associated with mathematics and his/her beliefs towards the subject which could be either positive or negative." Ertem&Alkan (2003) defines students' attitude towards mathematics as the behaviour of the students towards the subject by giving priority for mathematics assignment taught in the school . Students' attitudes toward mathematics can have an impact on their overall academic achievement as well as their engagement rate. Students' attitudes reflect their self-confidence, enjoyment, motivation, and fear about mathematics. A negative attitude affects a student's motivation to persevere with a math issue. School and home environments, instructor attitudes and views, teaching technique, parental attitudes, parents' education, and students' impressions of the school are all elements that influence kids' attitudes toward learning mathematics. A teacher can play an active role in helping pupils develop a positive attitude toward mathematics and accept the challenges of everyday life by encouraging and preparing them.

Teachers' attitude towards mathematics :

Teachers' attitudes about mathematics and students' attitudes toward mathematics have a significant relationship. Students may not develop a favourable attitude about mathematics if their teachers have a bad attitude toward the topic. A teacher's negative attitude might harm pupils' academic performance and raise psychological illnesses and physical stress symptoms. The mathematics instructor has a significant impact on students' attitudes about mathematics by exhibiting a favourable attitude toward the subject's instruction in the classroom. Schofield (1981) found that positive instructor attitudes toward mathematics were linked to excellent student achievement. Bridget, Vemberg, Twemloow, Fonag, and Dill (2008) investigated how instructors' attitudes affected students' academic performance and behaviour. According to the study, pupils who had dedicated teachers had more courage and desire to confront any challenges in the classroom. Teachers' attitudes about the potential of ICT in teaching and learning have been viewed as important prerequisites for successful deployment of new technologies (Ertmer,2005; Eickelmann,2011). Because they have greater expertise with ICT and prefer more involvement in the classroom, young instructors have a favourable attitude

toward the incorporation of ICT in mathematics classrooms. They are more at ease utilising ICT in the mathematics classroom than in the traditional classroom. The usage of a computer, whiteboard, and projector in the teaching-learning process has a direct impact on teachers' attitudes. The ability of a student to learn mathematics using ICT is greatly determined by the attitude of the teachers and their willingness to use technology in the classroom (Teo, 2006). As a result, the attitude of teachers toward ICT tools is crucial to the successful deployment of technology in the teaching-learning process (Kluever ,et.al.,1994).

Students' attitude towards technology:

In order to learn mathematics, one must have a positive attitude. It always has an impact on a student's academic performance and learning progress. From various dimension Vries (1988)refer students' attitude towards technology as the interest of students on using technology , career aspiration , perceived consequences of technology , students' perception on using technology , difficulty and gender issue . Several studies (e.g.Volk and Yip in lnt J Technol Des Edu 9:57-71 , 1999 ; Jones et al. In sci Edu 84(2):180-192, 2000 ; George in lnt J Sci Edu 28(6):571-589, 2006; Salminen-Karisson in lnt J Sci Edu 29(8):1019-1033, 2007) identified that students' nature are related with their attitudes towards technology. Learners have more opportunity to explore and interact with mathematical concepts because to technology. Students can use games, simulations, and digital tools to explore and discover new things. The use of technology in the classroom is thought to have a favourable impact on student achievement and attitudes toward lessons. Students' attitude towards ICT can be defined as the student's general evaluation and feeling of favour or hatred towards ICT technologies and specific ICT related activities. In technology-integrated classes, students are encouraged to participate actively in the learning process, making learning more enjoyable and appealing to them (Smaldino,Russell,Heinich&Molenda,2005).It is undeniable that technology has a great impact on every aspect of modern life. According to Turkmen (2006) "children today need the learning media which may encourage them to engage in the learning process." Becta(2003) summarised the key benefits – ICT promotes greater collaboration among students and encourages communication and the sharing of knowledge .

Objectives of the study :

1.To study the students' attitude towards learning mathematics from both SEBA and CBSE students in digital classroom and traditional classroom.

2 . To investigate the attitudes of students in both government and private sector schools toward learning mathematics in both digital and traditional classrooms.

3.To study the attitudes of male and female students regarding mathematics learning in both digital and traditional classrooms.

4. To study the relationship between students' attitude and academic achievement towards mathematics in digital and traditional classroom .

Hypotheses :

H_{01}.There is no significant difference between the learning attitudes towards mathematics in digital classroom and traditional classroom from   SEBA background students .

H_{02}. There is no significant difference between the learning attitudes towards mathematics in digital classroom and traditional classroom from   CBSE background students

H_{03}. There is no significant difference between the students' attitude of government school in digital classroom and traditional classroom .

H_{04}. There is no significant difference between the students' attitude of private school in digital classroom and traditional classroom

H_{05}. There is no significant difference between the male students' attitude towards learning mathematics in digital classroom and traditional classroom .

H_{06}. There is no significant difference between the female students' attitude towards learning mathematics in digital classroom and traditional classroom.

H_{07}. There is no significant difference between overall students' attitude towards learning mathematics in digital classroom and traditional classroom .

H_{08}. There is no significant relationship between the students' attitude and their academic achievementtowards mathematics in digital classroom .

H_{09}. There is no significant relationship between the students' attitude and their academic achievement towards mathematics in traditional classroom .

Operational definition of terms used:

Students' attitude towards learning mathematics :Students' attitude toward mathematics is defined as a favourable or negative emotional tendency to think, feel, and perceive the topic (Jovanovic and King 1998). According to Neale (1969), students' attitudes are defined by a like or dislike of mathematics, as well as a disposition to engage in or avoid mathematical activities.

Digital classroom : A digital classroom is one in which all of the seats in the room are taken up by technology. To improve student learning, these classrooms are entirely centred on instructional applications, websites, and software.

Traditional classroom :A traditional classroom is one in which the teacher communicates with the pupils face to face rather than through a third-party media. Teachers' lectures, reading books, taking notes, and printed materials are all used in these classrooms.

Delimitation of the study:

   (1) The study was confined to the students studying in IX standard only .
   (2) The study was limited to the age group of 14-16 years .
   (3) The schools incorporatedin the sample were only from-
          (i) Govt. and Govt. Provincialized schools under SEBA
         (ii) Permitted Private schools under SEBA
         (iii) Affiliated Private schools under CBSE
   (4) The sample size for the study was limited to 400 secondary students of different schools in Guwahati city.
   (5) Schools only English and Assamese medium were included in the sample .
   (6) " Blind schools" and "Deaf and dumb schools" are not included in the study .

Method:

The researcher adopted descriptive survey method for the present study .

Population:

The population of the present study constituted all the secondary students (9th standard) studying in both government and private institutions from SEBA and CBSE(Pvt only) belonging to Guwahati city of Kamrup(M) District , Assam .

Sample size determination :

Yamane's formula is used for calculation of sample size .

$$n = \frac{N}{1 + N(e)^2}$$

where N is the population size and e is the level of precision .

Let this formula be used for our population in which N=26239 with $\pm$ 5% precision . Assuming 95% confidence level and $p = 0.5$ we get sample size as

$$n = \frac{26239}{1 + 26239\ (0.05)^{\ 2}} = 393.99 = 400 \text{ (Rounded)}$$

Out of this sample 186 students from digital classroom and 214 students from traditional classroom are selected .

Sampling Method :

Sampling Technique	:	Multistage sampling
First Stage	:	Schools using ICT tools selected at random.
SecondStage	:	Datacollectedfromtheselectedstudentsusing Probability proportional to size (PPS)

ResearchInstrument:

The study used two types of research instrument

- Interview method
- Structuredquestionnaire

Statistical techniques used:

Mean , Standard Deviation , "t" test and correlation

Result and Discussions :

Hypothesis H$_{01}$

Table-1: t-test for students' attitude of SEBA schools in digital classroom and traditional classroom

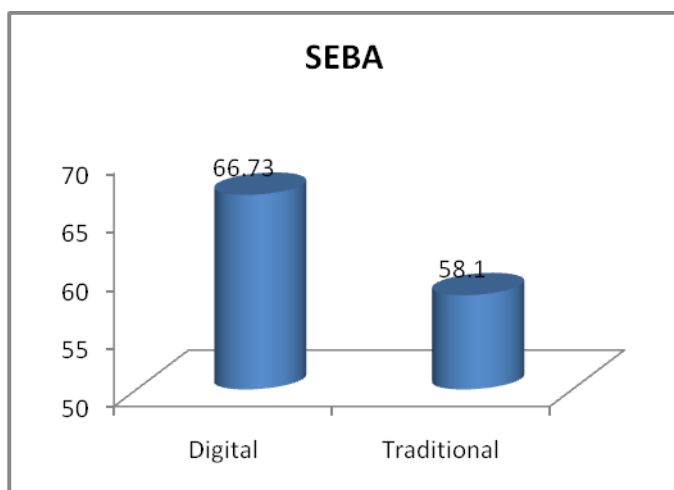| Category	N	Mean	Standard Deviation	Std. Error Mean	Mean Difference	t-value	df	Sig.(2 tailed)
Digital	103	66.73	6.85	0.67	8.62	12.03	293	.000
Traditional	192	58.10	5.27	0.38				

Figure-1 : Bar chart showing students' attitude of SEBA
school in digital and traditional classroom

The table-1 reveals that themean scores of students' attitude of SEBA Schools in digital classroom is 66.73 and traditional classroom is 58.10 ; the standard deviation of students' attitude in digital classroom and traditional classroom are 6.85 and 5.27 respectively .The mean score of digital class room is higher than the traditionalclassroom.The t-value= 12.03, df=293andp=.000 reflects that the difference between digital classroom and traditional classroom has significant difference at 1% level . Hence , Null hypothesis is rejected that there is no significant difference between the learning attitudes in digital and traditional classroom from   SEBA background students.

Hypothesis H_{02}
Table-2:t-test for Students' attitude of CBSE schools in digital classroom and traditional classroom

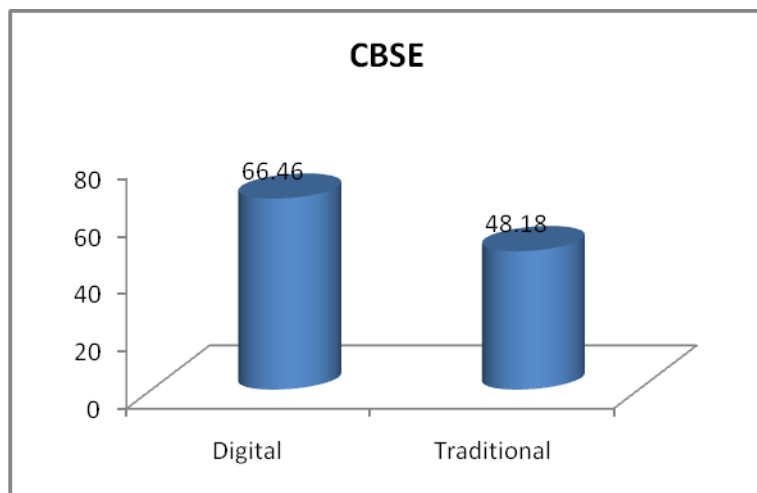| Category	N	Mean	Standard Deviation	Std. Error Mean	Mean Difference	t-value	df	Sig.(2 tailed)
Digital	83	66.46	7.16	0.79	18.28	10.96	103	.000
Traditional	22	48.18	6.07	1.29				

Figure-2 :Bar chart showing students' attitude of CBSE school in
digital and traditional classroom

The table-2 shows that mean scores of students' attitude of CBSE Schools in digital classroom is 66.46 and traditional classroom is 48.18 ; the standard deviation in digital classroom and traditional classroom are 7.16 and 6.07 respectively . The result indicates that the mean score of digital classroom is higher than the traditional classroom. The t-value= 10.96, df= 103 and p=.000 conclude that the difference of digital classroom and traditional classroom has found significant at 1% level. Hence , Null hypothesis is rejected that. there is no significant difference between the learning attitudes in digital and traditional classroom from CBSE background students.

Hypothesis H$_{03}$

Table-3: t-test for students' attitude of government school in digital classroom and traditional classroom

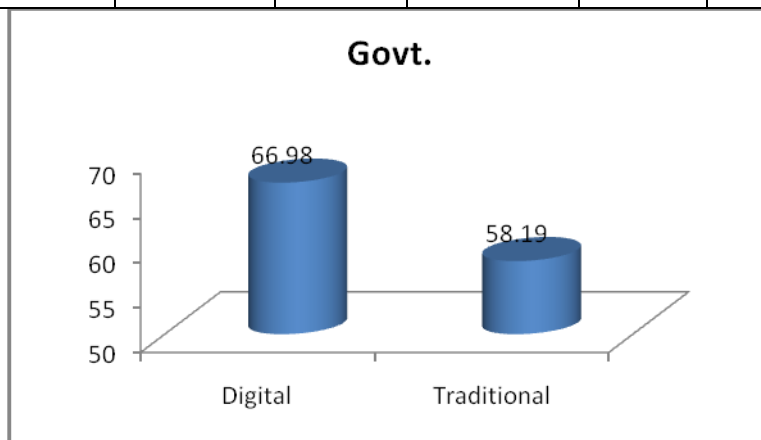| Category	N	Mean	Standard Deviation	Std. Error Mean	Mean Difference	t-value	df	Sig.(2 tailed)
Digital	47	66.98	6.55	0.95	8.79	9.20	172	.000
Traditional	127	58.19	5.21	0.46				

Figure-3 **:** Bar chart showing students' attitude of government school
in digital and traditional classroom

The table-3 indicates that mean scores of students' attitude of government school in digital classroom is 66.98 and traditional classroom is 58.19 ; the standard deviation of students' attitude in digital classroom and traditional classroom are 6.55 and 5.21 respectively . The result reveals that the mean score of digital classroom is higher than the traditional classroom in government school. The t-value= 9.20, df=172 and p=.000 reflects that the difference digital classroom and traditional classroom has found significant at 1% level . Hence Null hypothesis is rejected thatthere is no significant difference between the students' attitude of government school in digital and traditional classroom .

Hypothesis H$_{04}$
 Table-4: t-test for students' attitude of private school in digital and traditional classroom

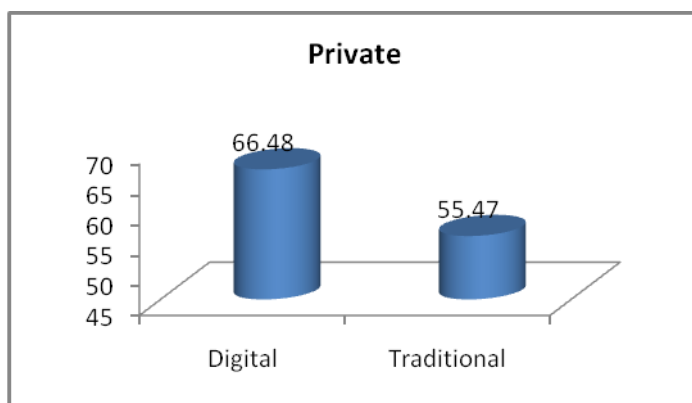| Category	N	Mean	Standard Deviation	Std. Error Mean	Mean Difference	t-value	df	Sig.(2 tailed)
Digital	139	66.48	7.13	0.60	11.01	11.37	224	.000
Traditional	87	55.47	7.01	0.75				

Figure-4: Bar chart showing students' attitude of private school in
 digital and traditional classroom

The table-4 reveals that mean scores of students' attitude of Private Schools in digital classroom is 66.48 and traditional classroom is 55.47. The standard deviation of students' attitude are 7.13 and 7.01 respectively .The result conclude that the mean score of digital classroom is higher than the traditional classroom. The t-value= 11.37, df=224 and p=.000 reflects that the difference of digital classroom and traditional classroom has found significant at 1% level. Hence Null hypothesis is rejected that there is no significant difference between the students' attitude of private school in digital and traditional classroom .

Hypothesis H$_{05}$

Table-5 :t-test for attitude of male students in digital classroom and traditional classroom

Category	N	Mean	Standard Deviation	Std. Error Mean	Mean Difference	t-value	df	Sig.(2 tailed)
Digital	110	66.87	6.16	0.59	7.86	10.26	205	.000
Traditional	97	59.01	4.64	0.47				
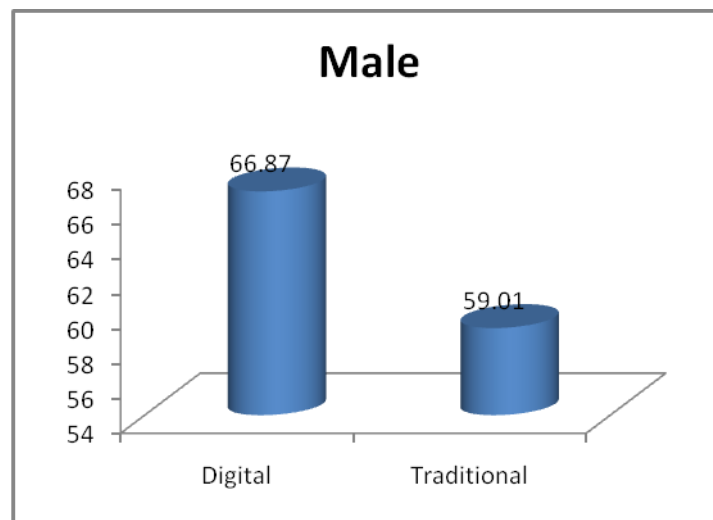
Figure-5 : Bar chart showing attitude of male students in digital and traditional classroom

The table-5 shows the mean scores ofattitude for male student in digital classroom as 66.87 and traditional classroom as 59.01 ; the standard deviation of students' attitude are 6.16 and 4.64 in digital classroom and traditional classroom respectively . The result indicates that the mean score of attitude for male student   in digital class room is higher than the traditional classroom. The t-value= 10.26, df=205 and p=.000 conclude that the difference of digital classroom and traditional classroom has found significant at 1% level. Hence, Null hypothesis is rejected that there is no significant difference betweenthe male students' attitude towards learning mathematics in digital and traditional classroom .

Hypothesis H$_{06}$

Table-6 : t-test for attitude of female students in digital classroom and traditional classroom

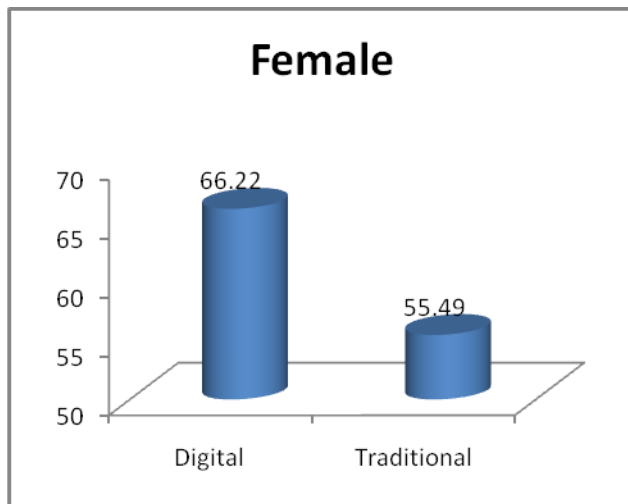| Category	N	Mean	Standard Deviation	Std. Error Mean	Mean Difference	t-value	df	Sig.(2 tailed)
Digital	76	66.22	8.03	0.92	10.74	10.00	191	.000
Traditional	117	55.49	6.76	0.63				

Figure-6 : Bar chart showing attitude of female
students in digital and traditional classroom

The table-6 reveals that mean scores of attitude for female student in digital classroom is 66.22 and traditional classroom is55.49 ; the standard deviation of students' attitude are 8.03 and 6.76 in digital classroom and traditional classroom respectively . The result indicates that the mean score of digital class room is higher than the traditional classroom. The t-value= 10.00, df=191 and p=.000. reflects that the difference of Digital classroom and traditional classroom has found significant at 1% level Traditional and Digital classroom has found significant at 1% level . Hence, Null hypothesis is rejected that there is no significant difference between the female students' attitude towards learning mathematics in digital and traditional classroom.

Hypothesis H_{07}
Table-7 : t-test for overall students' attitude towards learning mathematics in digital classroom and traditional classroom

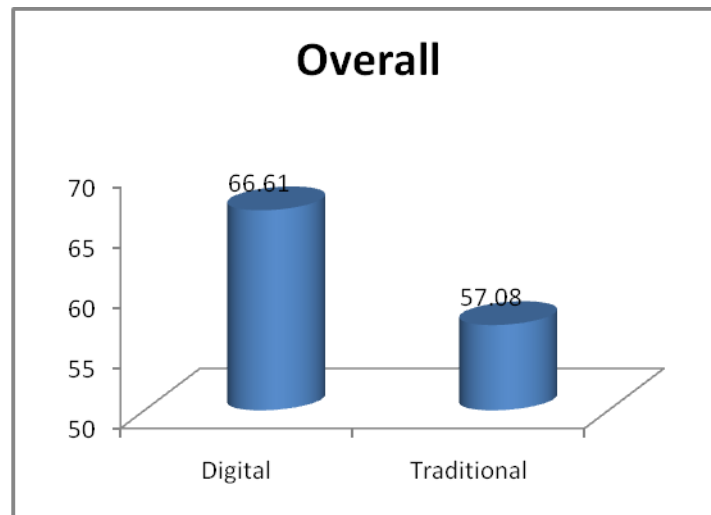| Category	N	Mean	Standard Deviation	Std. Error Mean	Mean Difference	t-value	df	Sig.(2 tailed)
Digital	186	66.61	6.97	0.51	9.52	14.53	398	.000
Traditional	214	57.08	6.14	0.42				

Figure-7 : Bar chart showing overall students' attitude in
digital and traditional classroom

From the   table-7,   it is observed   that overall mean score of students' attitude in digital classroom is 66.61 and   traditional classroom is 57.08 ; the standard deviation of students' attitude in digital classroom and traditional classroom are 6.97 and 6.14 respectively . The mean difference is 9.52 showing that the mean score of digital classroom is higher than the traditional classroom. The t-value = 14.53, df= 398 and p=.000 reflects that the difference between digital classroom and traditional has significant difference at 1% level . Hence null hypothesis is rejected that there is no significant difference between overall students' attitude towards learning mathematics in digital and traditional classroom .

Hypothesis H_{08}

Table-8 : Pearson Correlation between students' attitude and academic achievement in digital Classroom

	Overall N=186	**SEBA N=103**	**CBSE N=83**	**Govt. N=47**	**Pvt. N=139**	**Male N=110**	**Female N=76**
Digital	.326**	.364**	.316**	.423**	.297**	.301**	.360**
P-value	.000	.000	.004	.003	.000	.001	.001

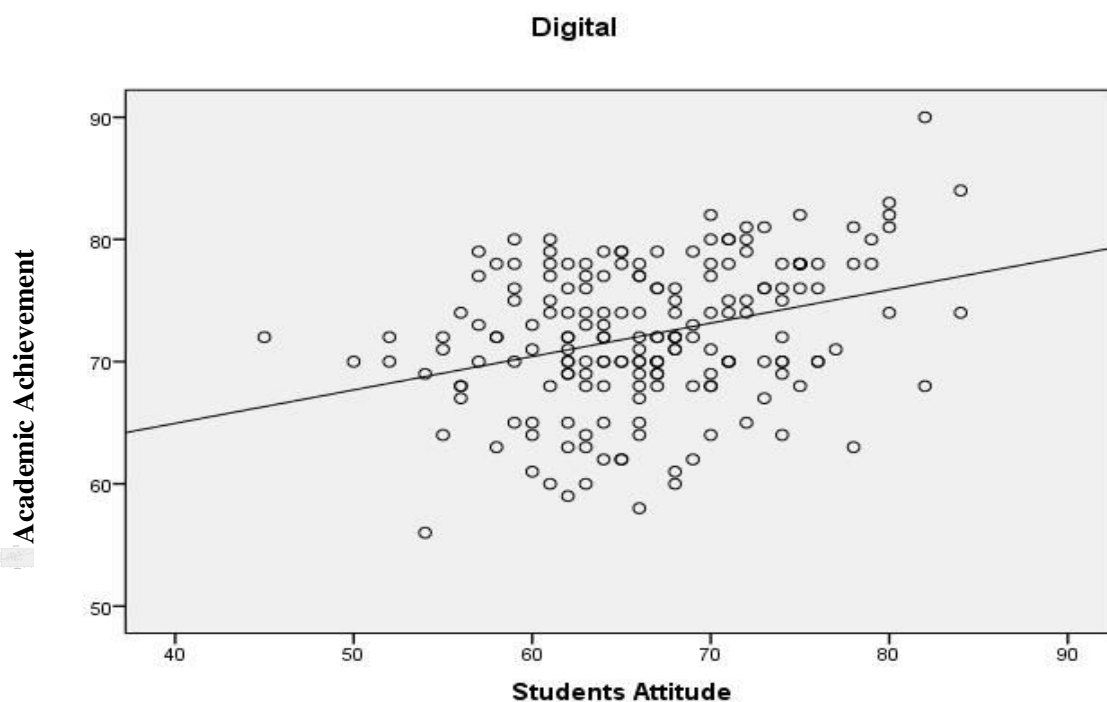****. Correlation is significant at the 0.01 level (2-tailed).**

Digital

Figure-8.1**:** Scatter plot design showing the relationship between students'
attitude and academic achievement in digital classroom

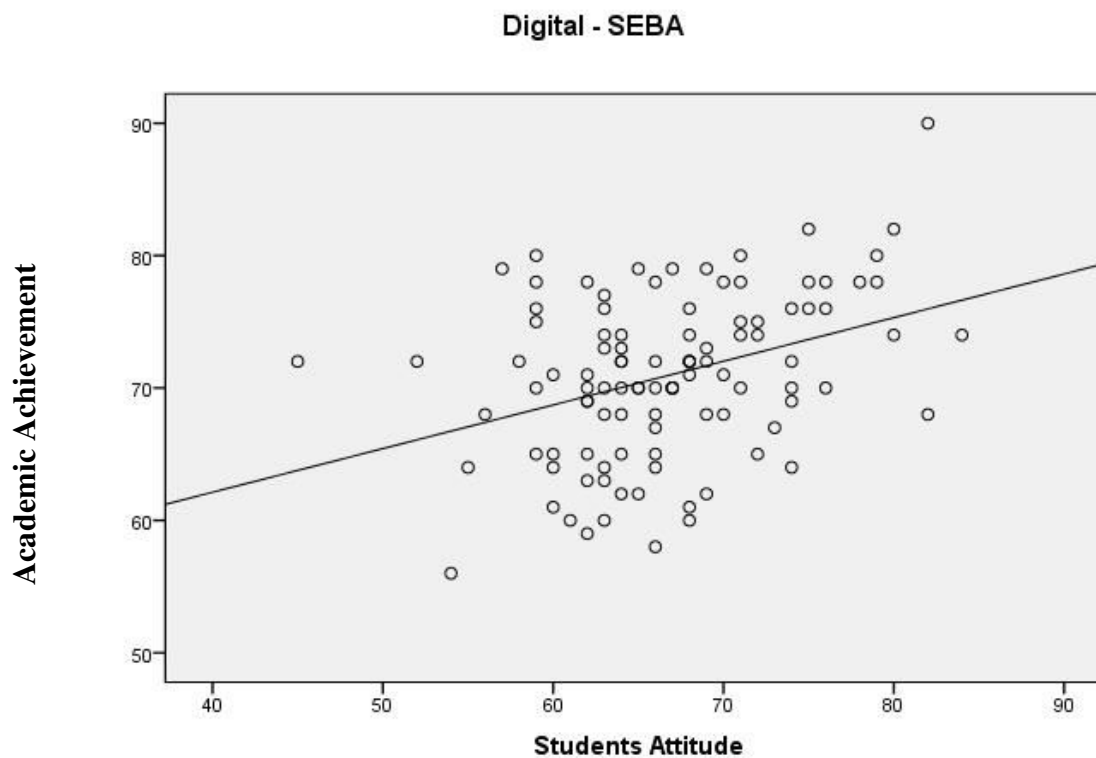**Digital - SEBA**

Figure 8.2 : Scatter plot design showing the relationship between students' attitude and
academic achievementin SEBA school

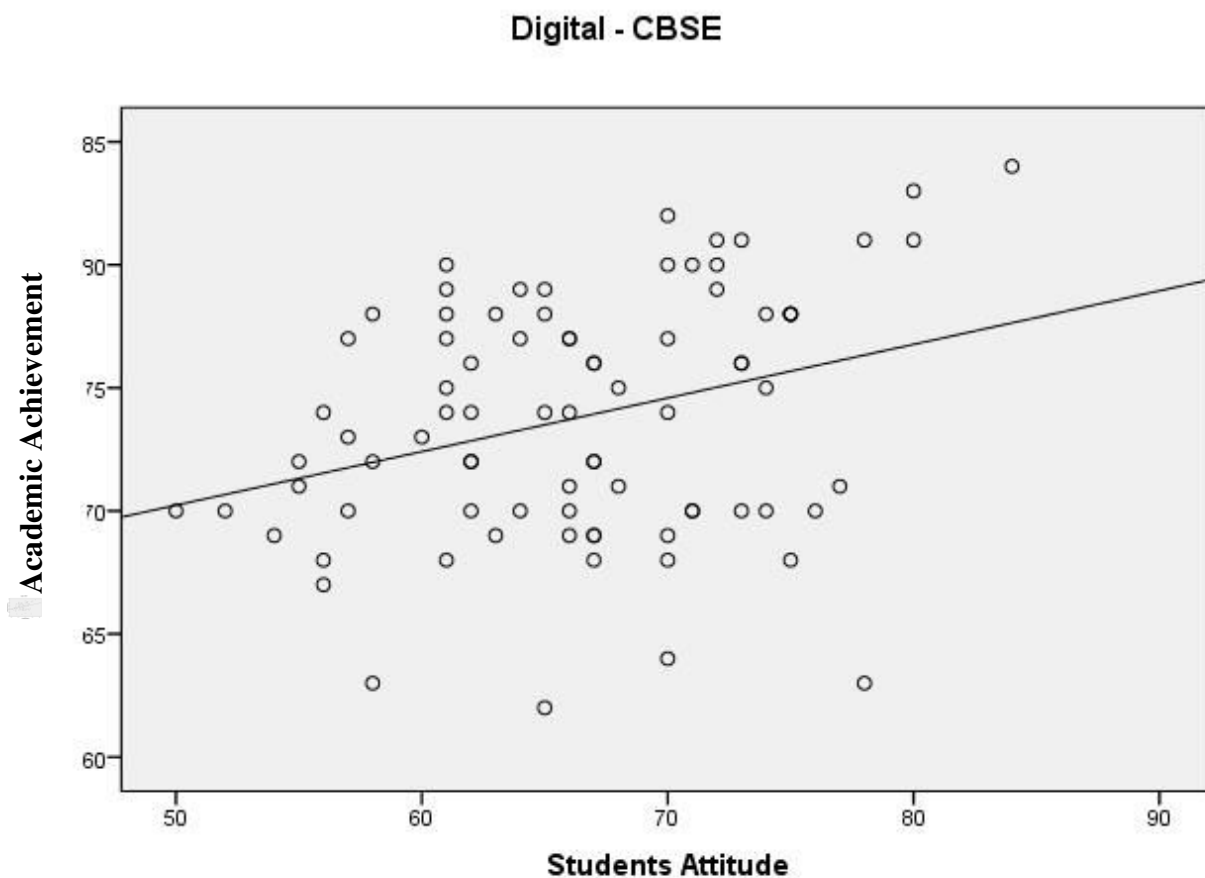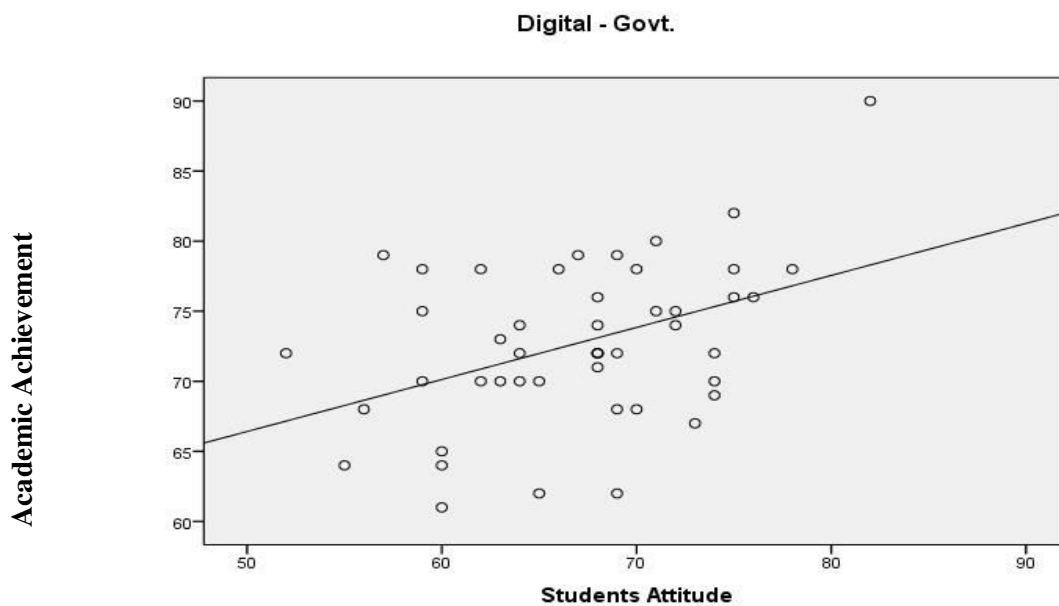**Digital - CBSE**

Figure-8.3 : Scatter plot design showing the relationship between students' attitude and academic achievement in CBSE school

Digital - Govt.

Figure-8.4: Scatter plot design showing the relationship between students' attitude and academic achievement in Govt. school
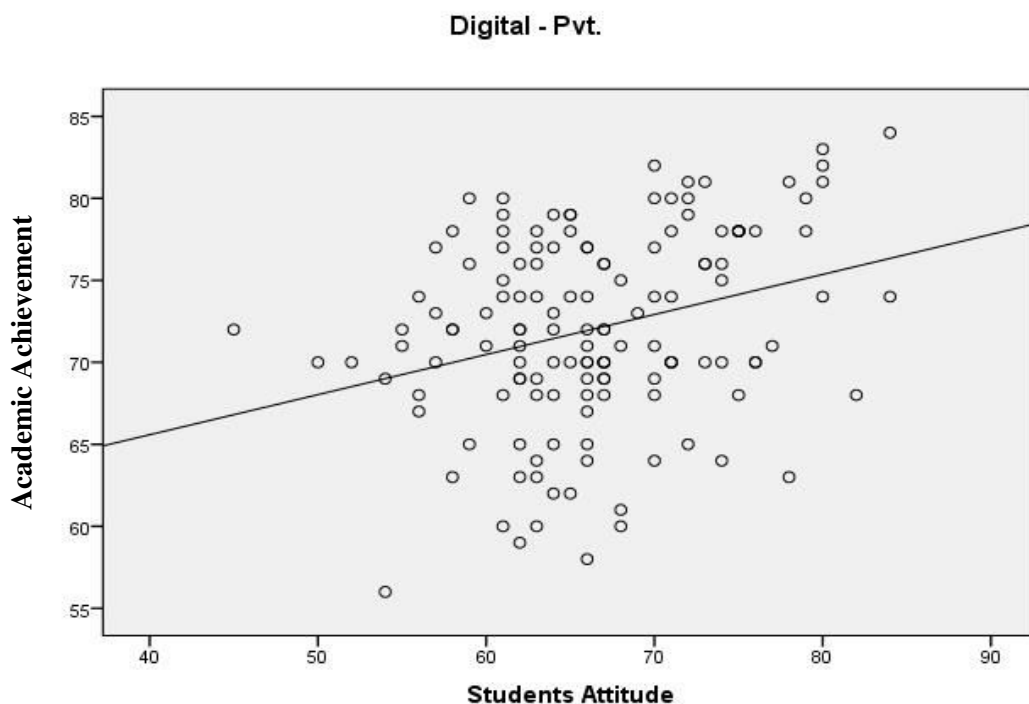
Figure-8.5: Scatter plot design showing the relationship between students' attitude and academic achievement in private school
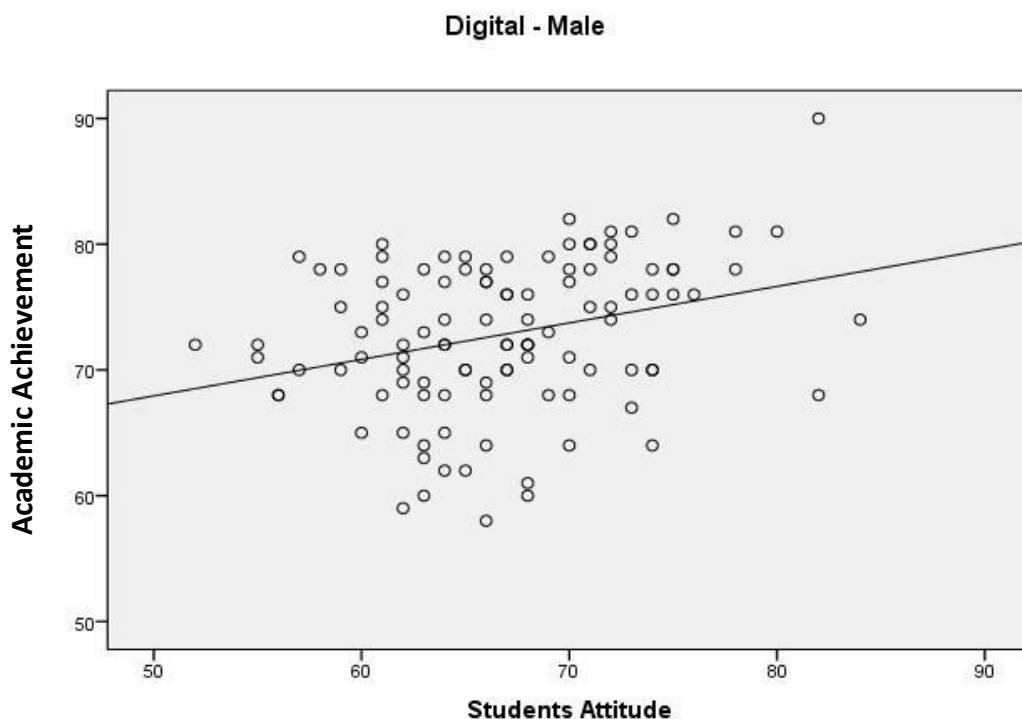

Figure-8.6: Scatter plot design showing the relationship between students' attitude and academic achievement for male student
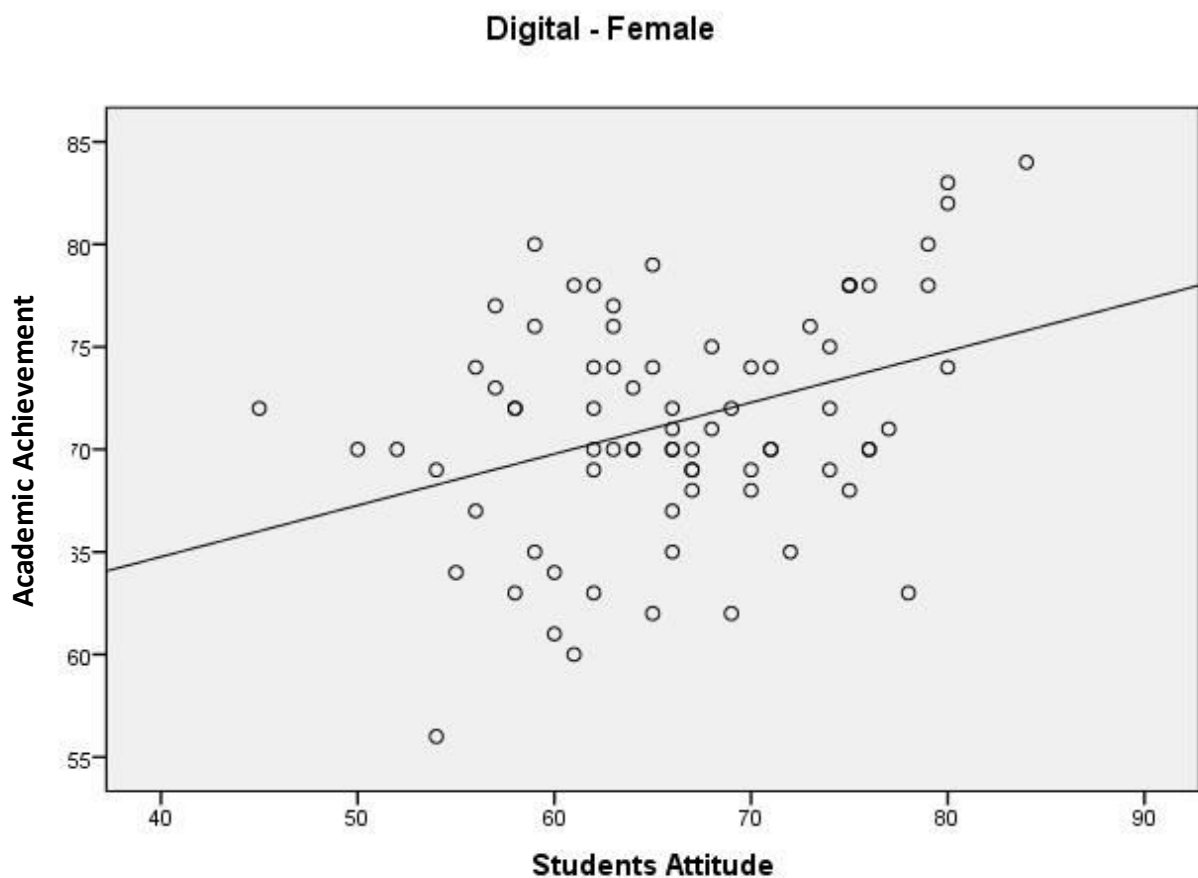
Figure-8.7: Scatter plot design showing the relationship between students' attitude and academic achievement for female student

As depicted in the above table-8, students attitude and academic performance are positively correlated (Overall, r=.326; SEBA, r=.364; CBSE, r=.316; Govt., r=.423; Pvt, r=.297; Male, r=.301 and Female, r=.360). In other words we can say that increasing of digital classroom services increases the academic achievement of the students. The relationship between students' attitude and academic achievement in digital classroom is significant at 1% level (P<1%). Hence the null hypothesis is rejected that there is no significant liner relationship between students' attitude and academic achievement in digital classroom .

Table-9 : Pearson Correlation between students' attitude and academic achievement in traditional Class room

	Overall N=214	SEBA N=192	CBSE N=22	Govt. N=127	Pvt. N=87	Male N=97	Female N=117
Traditional	.078	.082	.627**	.069	.017	.053	.151
P-Value	.253	.258	.002	.444	.878	.609	.104

**. Correlation is significant at the 0.01 level (2-tailed).

As depicted in the above table-8, students attitude on traditional class room with academic achievement is positively correlated (Overall, r=.078, SEBA, r=.082, CBSE, r=.627, Govt., r=.069, Pvt, r=.017, Male, r=.053 and Female, r=.151). In other words we can say that increasing attitude of thestudents in traditional class room also increases the academic achievement of the students. In CBSE school only, the relationship between attitude on traditional class room and academic achievement is significant at 1% level (P<.002). It is observed that the CBSE driving schools are well maintained the traditional class room system in achieving the academic achievement.

The overall attitude scores on traditional class room of the students correlated with the academic achievement is not significant at 5% level. Thus the null hypothesis is accepted that there is no significa**t** liner relationship between students' attitude and academic achievement in traditional classroom .

Findings of the study:

1.There is a significant difference between the learning attitudes towards mathematics in digital classroom and traditional classroom from SEBA background students .

2. There is a significant difference between the learning attitudes towards mathematics in digital classroom and traditional classroom from CBSE background students

3. There is a significant difference between the students' attitude of government school in digital classroom and traditional classroom .

4. There is a significant difference between the students' attitude of private school in digital classroom and traditional classroom

5. There is a significant difference between the male students' attitude towards learning mathematics in digital classroom and traditional classroom .

6. There is a significant difference between the female students' attitude towards learning mathematics in digital classroom and traditional classroom.

7. . There is a significant difference between overall students' attitude towards learning mathematics in digital classroom and traditional classroom

8. There is a significant relationship between the students' attitude and their academic achievement towards mathematics in digital classroom which means students' academic achievementis dependent on their attitude .

9 . There is no association between the students' attitude and their academic achievement towards mathematics in traditional classroom . Hence,it can be conclude that academic achievement of student is not dependent on their attitudes.

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